DETAILED ACTION

Claim Objections

Claim 21 is objected to because of the following informalities: As amended claim 21 contains two periods; one after step c, and one after step e. Appropriate correction is required.

Claim Rejections - 35 USC § 112

The following is a quotation of the second paragraph of 35 U.S.C. 112:

> The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

Claims 5-7, 15-17, 22 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

Claims 5-7, 15-17, 22 contain steps d and e. however, these steps are already present in claims 1, 13, 21, from which these claims depend.

Claim Objections

Allowable Subject Matter

Claims 5-9, 15-17, 22 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

Claims 1-4, 12-14, 18, 19, 21, are rejected under 35 U.S.C. 103(a) as being unpatentable over Leinberger et al. as shown in (Multi-Capacity Bin Packing Algorithms with Applications to Job Scheduling under Multiple Constraints), in view of Walser (US 6,031,984)

With respect to claim 1, 13, 19, 21, Leinberger teaches; assigning objects to processing units of a cluster of processing units, each one of the objects having an object size and an object load, ("In general, the d-capacity bin-packing algorithms are extensions of the single capacity bin-packing algorithms" page 4, paragraph 1) each one of the processing units having a storage capacity and a load capacity, the method comprising:

a) calculating an index based on object size and object load for each one of the objects, ("In the d-capacity formulation, however, the items are sorted based on a scalar representation of the d components." page 5 paragraph 4)

b) sorting the objects by index to provide a sequence of objects; ("First-Fit Decreasing (FFD) first sorts the list L in non-increasing order and then applies the First-Fit packing algorithm." page 5 paragraph 4)

c) for each processing unit of the cluster: ("In past massively parallel processing

systems, such as the TMC CM-5 and the CRI T3E, the scheduling problems consisted of allocating a single type of resource among the waiting jobs; the processing node. A Job was allocated the minimum number of nodes required to meet its largest resource requirement (e.g. memory, CPUs, I/O channels, ect.).” Leinberger Abstract)

assigning of one or more of the objects to the processing unit in sequential order until a remaining storage capacity and a remaining load capacity of the processing unit is too small for any of the remaining objects of the sequence; and (“The Next-Fit (NF) algorithm takes the next d-capacity item Xi and attempts to place it in the current bin Bk. If it does not fit then a new bin, Bk+1 is started.” page 5 paragraph 3)

removing the objects from the sequence;

d) determining a load and capacity balance between the processing units of the cluster, the determining comprising: (“In past massively parallel processing systems, such as the TMC CM-5 and the CRI T3E, the scheduling problems consisted of allocating a single type of resource among the waiting jobs; the processing node. A Job was allocated the minimum number of nodes required to meet its largest resource requirement (e.g. memory, CPUs, I/O channels, ect.).” Leinberger Abstract)

Leinberger does not teach:

determining a first threshold and a second threshold of each of the processing units based on a number of the processing units;

calculating a new remaining storage capacity as a difference between the first threshold and an aggregated size of objects assigned to the processing unit;

calculating a new remaining load capacity as a difference between the second threshold

and an aggregated load of objects assigned to the processing unit; and

e) performing step 1 c) again with the new remaining storage capacity and the new remaining load capacity

Walser teaches:

determining a first threshold and a second threshold of each of the processing units based on a number of the processing units; (“In step 14 an unsatisfied constraint is selected” Walser column 5 line 60)

calculating a new remaining storage capacity as a difference between the first threshold and an aggregated size of objects assigned to the processing unit;

calculating a new remaining load capacity as a difference between the second threshold and an aggregated load of objects assigned to the processing unit; and

e) performing step 1 c) again with the new remaining storage capacity and the new remaining load capacity. (“After the variables are initialized, the method iterates through a local search process to generate an approximately optimal solution.” Walser column 5 line 57)

A person of ordinary skill in the art would have modified Leinberger with the feedback system of Walser by changing the input constraints and fixing a number of iterations. This would have been done by selecting a valid value range for bins and wasted space of Leinberger. The limited set of constraints in bin packing, specifically wasted space, would be an obvious selection for optimization. It would have been obvious at the time the invention was made to a person of ordinary skill in the art

Regarding claims 2, 14, Leinberger teaches; wherein step 1 c) is carried out repeatedly (page 5 paragraph 3) until the sequence is empty. ("Again, the goal is to partition the list L into as few bins Bk as possible." page 5 paragraph 2)

Regarding claim 3, Leinberger teaches; wherein the remaining storage capacity is determined by the difference between the storage capacity of the processing unit and the aggregated size of objects being assigned to the processing unit. ("If it does not fit (ie, if Xij + Bkj > Cj for some j) then a new bin, Bk+1, is started." page 5 paragraph 3)

Regarding claim 4, Leinberger teaches; wherein the remaining load capacity is determined by the difference between the load capacity of the processing unit and the aggregated loads of objects being assigned to the processing unit. (page 5 paragraph 3)

Regarding claims 12, 18, Leinberger teaches; the index of an object is calculated based on the sum of the normalized object size and object load and based on the absolute value of a difference between the normalized object size and the normalized object load. ("In the d-capacity formulation, however, the items are sorted based on a scalar representation of the d components." page 5 paragraph 4)

Regarding claim 19, Leinberger teaches; A data processing system for determining a minimum number of processing units of a cluster of processing units for a given number of objects having various object sizes and object loads, the data processing system comprising:

means for calculating an index based on object size and object load for each one of the objects, (“In the d-capacity formulation, however, the items are sorted based on a scalar representation of the d components.” page 5 paragraph 4)

means for assigning of one or more of the objects to a processing unit in sequential order until a remaining storage capacity and/or a remaining load capacity of the processing unit is too small for consecutive objects of the sequence and for deleting of the objects that are assigned to the processing unit from the sequence[[.]] ,and (“The Next-Fit (NF) algorithm takes the next d-capacity item Xi and attempts to place it in the current bin Bk. If it does not fit then a new bin, Bk+1 is started.” page 5 paragraph 3)

means for outputting of the minimum number of the processing units. (“Again, the goal is to partition the list L into as few bins Bk as possible.” page 5 paragraph 2)

d) means for improving a balance between the processing units by (“In past massively parallel processing systems, such as the TMC CM-5 and the CRI T3E, the scheduling problems consisted of allocating a single type of resource among the waiting jobs; the processing node. A Job was allocated the minimum number of nodes required to meet its largest resource requirement (e.g. memory, CPUs, I/O channels, ect.).” Leinberger Abstract)

means for determining a first threshold and a second threshold of each of the processing units based on a number of the processing units;

means for calculating a new remaining storage capacity as a difference between the first threshold and the aggregated size of objects assigned to the processing unit;

means for calculating a new remaining load capacity as a difference between the

second threshold and the aggregated load of objects assigned to the processing unit; and

means for performing step 19 b) again with the new remaining storage capacity and the new remaining load capacity. ("If it does not fit (ie, if Xij + Bkj > Cj for some j) then a new bin, Bk+1, is started." page 5 paragraph 3. alternatively "Initially, bin B1 is created and the first item in the list L, X1, is placed into this bin. Next, the list L is scanned from beginning to end searching for the next element Xi which will fit into bin B1. Place each successive Xi which fits into bin B1. When no element is found which will fit, then bin B2 is created." Page 6 paragraph 3)

Regarding claim 21, Leinberger teaches; A blade server comprising executable instructions, which when executed cause a processor associated with the blade server to execute a method for dynamically assigning objects to a plurality of blade servers, each one of the objects having an assigned index that is based on object size and object load, the method comprising:

a) sorting of the objects by index to provide a sequence of objects; ("In the d-capacity formulation, however, the items are sorted based on a scalar representation of the d components." page 5 paragraph 4)

b) for each processing unit of the cluster:

assigning one or more of the objects to the processing unit in sequential order until a remaining storage capacity and/or a remaining load capacity of the processing unit is too small for any of the remaining objects of the sequence; ("The Next-Fit (NF) algorithm takes the next d-capacity item Xi and attempts to place it in the current bin Bk.

If it does not fit then a new bin, Bk+1 is started.” page 5 paragraph 3)

c) removing the assigned objects from the sequence[,]

d) determining a load and capacity balance between the processing units of the cluster, the determining comprising: (“In past massively parallel processing systems, such as the TMC CM-5 and the CRI T3E, the scheduling problems consisted of allocating a single type of resource among the waiting jobs; the processing node. A Job was allocated the minimum number of nodes required to meet its largest resource requirement (e.g. memory, CPUs, I/O channels, ect.).” Leinberger Abstract)

determining a first threshold and a second threshold of each of the processing units based on a number of the processing units;

calculating a new remaining storage capacity as a difference between the first threshold and an aggregated size of objects assigned to the processing unit;

calculating a new remaining load capacity as a difference between the second threshold and an aggregated load of objects assigned to the processing unit; and

e) performing step 21 b) again with the new remaining storage capacity and the new remaining load capacity. (“If it does not fit (ie, if Xij + Bkj > Cj for some j) then a new bin, Bk+1, is started.” page 5 paragraph 3. alternatively “Initially, bin B1 is created and the first item in the list L, X1, is placed into this bin. Next, the list L is scanned from beginning to end searching for the next element Xi which will fit into bin B1. Place each successive Xi which fits into bin B1. When no element is found which will fit, then bin B2 is created.” Page 6 paragraph 3)

Claims 1-4, 12-14, 18, 19, 21, are rejected under 35 U.S.C. 103(a) as being unpatentable over Leinberger et al. as shown in (Multi-Capacity Bin Packing Algorithms with Applications to Job Scheduling under Multiple Constraints), in view of Kang et al. (Algorithms for the variable sized bin packing problem)

With respect to claim 1, 13, 19, 21, Leinberger teaches the elements as shown above.

Leinberger does not teach:

determining a first threshold and a second threshold of each of the processing units based on a number of the processing units;

calculating a new remaining storage capacity as a difference between the first threshold and an aggregated size of objects assigned to the processing unit;

calculating a new remaining load capacity as a difference between the second threshold and an aggregated load of objects assigned to the processing unit; and

e) performing step 1 c) again with the new remaining storage capacity and the new remaining load capacity

Kang teaches said elements, "In IFFD (respectively, IBFD), we first allocate all the itemsto the largest size bins using FFD (respectively, BFD). And get a feasible solution. We then obtain another solution by repacking the items in the last bin of the solution to the next largest bins using FFD (respectively, BFD)." (Kang page 367 paragraph 2)

A person of ordinary skill in the art would have included the additional iteration of Kang in the invention of Leinberger by repacking the items according to Kang. It would

have been obvious at the time the invention was made to a person of ordinary skill in the art to include Kang in order to reduce the wasted space in a bin.

Claims 3-4, 12, 14, 18, are rejected for the reasons detailed above.

Claims 10, 11, 20, and 23 are cancelled.

Response to Arguments

Applicant's arguments, see page 16, filed 12/01/2008, with respect to claims 1, 13, 19, 21 under 35 USC 102 have been fully considered and are persuasive. The rejection of claims 1-23 have been withdrawn.

Applicant's arguments, see page 16, filed 12/01/2008, with respect to the rejection(s) of claim(s) 1, 13, 19, 21 under 35 USC 102 have been fully considered and are persuasive. Therefore, the rejection has been withdrawn. Leinberger does not teach a repacking or rebalancing of any bins. However, upon further consideration, a new ground(s) of rejection is made in view of Leinberger in view of Walser, and Leinberger in view of Kang.

Applicant's arguments, see page 15-16, filed 12/01/2008, with respect to claims 5-9, 15-17, 22 have been fully considered and are persuasive. The rejection under 35 USC 103 of claims 5-9, 15-17, 22 has been withdrawn. These claims, however, are objected to as depending upon rejected claims.

Conclusion

THIS ACTION IS MADE FINAL. Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Michael Chao whose telephone number is (571)270-5657. The examiner can normally be reached on 8-4 Monday through Thursday.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Andrew Caldwell can be reached on (571)272-3868. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/M. C./
Examiner, Art Unit 2442

/Andrew Caldwell/
Supervisory Patent Examiner, Art Unit 2442